REMARKS

Applicant thanks for the Examiner's thorough examination of the pending claims and thoughtful comments, and for a subsequent telephonic interview. Applicant will sequentially address the issues raised by the Examiner.

I. Office Action (5/15/2007) Summary

Claims 1, 3-7, 9-13 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Venkataraman (a Ph.D. dissertation entitled: "Modeling, Analyzing, and Optimization of Cylindrical Stiffened Panels for Reusable Launch Vehicle Structures" at University of Florida, 1999, hereinafter "Venkataraman"), in view of Tyron, III et al. (U. S. Patent No. 7,006,947, hereinafter "Tyron"). Applicant respectfully traverses the rejections.

II. Interview (8/2/2007) Summary

The telephonic interview was conducted between the Examiner, Applicant and the undersigned (representative of the Applicant) on August 2, 2007. The 35 U.S.C. §103(a) rejection regarding Claim 1 was discussed with respective to cited references – Venkataraman and Tyron. Although no definitive agreement was reached with the Examiner, the undersigned and Applicant appreciate the opportunity to understand the interpretation of the Examiner on the claims.

III. Claim Status Summary

No claim has been amended in this response. Claims 1, 3-7 and 9-13 are pending.

IV. Examiner Typographical Error in OA

In line 6 Page 4 of the OA, the sentence "Although Venkataraman does specifically teach the term high likelihood bifurcation region of a FEA, he teaches …" appears in error. It seems that the Examiner meant to write

"Although Venkataraman does **not** specifically teach the term high likelihood bifurcation region of a FEA .." (*Emphasis added*).

This typographical error was confirmed by the Examiner in the August 2, 2007 interview. Therefore, the statement should read ".. Venkataraman does **not** specifically teach the term high likelihood bifurcation region of a FEA ..".

V. The 35 U.S.C. § 103(a) Rejections

A. Independent Claim 1

It is axiomatic that the combination of cited references in a §103 rejection must disclose every element in the rejected claim. MPEP 2143.03. Claim 1 is reproduced as follows:

> A method for distinguishing effects due to bifurcation from effects due to design variable changes used in finite element analysis (FEA) for designing a structural product by a user of the FEA, the method comprising:
>
> obtaining in a computing device a plurality of finite element analysis responses for a set of design experiments, wherein each of the set of design experiments has a specific combination of design variables values;
> constructing a metamodel from the plurality of finite element analysis responses;
> selecting a set of outliers from the set of design experiments whose finite element analysis responses are not predicted by the metamodel;
> identifying high likelihood bifurcation region of a FEA model that represents the structural product by plotting an indicating quantity of the finite element analysis responses; and
> examining the finite element analysis responses of a couple of the outliers to determine whether the effects are due to the bifurcation or due to the design variable changes, wherein the couple of the outliers is maximum and minimum of the set of outliers.

(*Emphasis added*)

As clearly recited in claim 1 and indicated in FIG. 1 and corresponding descriptions thereof (see paragraphs [0039] and [0011]-[0014] in the

Specification), a metamodel (e.g., a response surface constructed using least squares fitting) is constructed from the structural responses before the high likelihood bifurcation of a FEA model can be identified and examined to distinguish whether one or more outliers is due to the effects of bifurcation or due to the design variable changes. It is emphasized that the metamodel in the present invention was created without any prior knowledge whatsoever about which portion or part of the structural product would result in a bifurcation (e.g., buckling) in any or all of the design experiments. In other words, the metamodel is created **before** the bifurcation is identified or determined.

In the current Office Action, Venkataraman is cited to reject claim 1 by the Examiner; however, the Examiner admits that Venkataraman does not teach the term high likelihood bifurcation region of a FEA. (see section IV above) Therefore the Examiner relies on Tyron to make the 35 U.S.C. § 103(a) rejection. Specifically, the Examiner asserts: "... Nevertheless, Tyron, III et al. substantially teaches identifying failure mechanism, such as buckling/bifurcation in a FEA and examine the FEA to determine which of the identified failure mechanism is active (*fig. 2a-d, col. 5 lines 36-col. 6 lines 45; also see fig. 5*)." Lines 13-15, Page 4, OA

Applicant respectfully disagrees. In the very description cited by the Examiner, Tyron discloses that "In Fig. 2(a), … by identifying failure mechanism at step 40 through review of warranty and failure data (step 50) and research of literature (step 52) to determine which of the identified failure mechanisms are actual active failure mechanisms (step 54). …", (lines 39-43, col. 5) ".. Failure mechanisms are then modeled in step 42 by evaluating failure physics ..". (lines 54-55, col. 5) Then Tyron continues that "FIGS. 2(a)-2(c) show how to formulate probabilistic strategy at step 46. …" (lines 9-10, col. 6) and "… Two

primary probabilistic approaches may be appropriate for prediction analysis 30 (FIG. 1): fast probability methods (FPM), or simulation techniques (ST). FPM includes response surface FPM 88 and direct FPM 92 techniques. A response surface approximates the failure physics of the system with a single mathematical relationship. …" (lines 22-30, col. 6). In other words, a response surface (e.g., a metamodel) is created to approximate active failure mechanisms (e.g., buckling, fatigue and/or corrosion) **after** one or more of failure mechanisms have been identified by the user with prior knowledge (i.e., active failure mechanism).

In sum, neither Venkataraman nor Tyron, view alone or in combination, discloses, teaches or suggests the metamodel is created before a possible bifurcation is identified or determined. Venkataraman and Tyron always require the prior knowledge of failure mechanism (e.g., fatigue, buckling, etc.). Then response surfaces are created accordingly to predict the magnitudes of these structural responses (e.g., fatigue, buckling, etc.) for each specific value of the design variables. Therefore, Venkataraman and Tyron, viewed alone or in combination, teach away from the recited steps in claim 1, specifically, the steps of: "constructing a metamodel …", "selecting a set of outliers …", then "identifying high likelihood bifurcation region of a FEA model …" and " examining the finite element analysis responses …".

Furthermore, the Examiner pointed out, during the telephonic interview, the following in Tyron ".. The system response model may be based on the explicit mathematical formulas of mechanics of materials, thermodynamics, etc. Computational methods such as finite element analysis and computational fluid analysis, are sometimes used to access the response of the system. .." (lines 14-18, col. 4) Applicant respectfully submits that the above disclosure does not teach or

suggest "identifying a high likelihood of bifurcation region of a FEA model after the metamodel is created and a set of design experiments is conducted". In the beginning of the above quoted section in Tyron states that : "[a]n embodiment [..] uses sensed data combined with probabilistic engineering analysis models to provide a more accurate method for predicting the probability of failure of a component or a system. .." (Lines 65-68 col. 3 and Line 1 col. 4) The embodiment described here requires prior knowledge of failure (e.g., sensed data), while the claimed invention of the instant application as recited in claim 1 does not require any prior knowledge of the failure mode before the metamodel is created. In fact, there may not even be any bifurcation, the outliers selected may all be caused by numerical noise.

In addition, the Examiner further asserts " … he (i.e., Venkataraman) teaches a Response Surface Methodology in which data points are selected or identified for the evaluation of response function in the design (*see pg. 136*) and that design points are chosen to maximize the predictive capability of approximating function and minimize variance error and constructed the response surface approximations for prediction of the response of other design points of interest (*see [pg.] 136-139, 170-173): also fig. 6.7-6.8 for a plot of Response surface prediction load and local bifurcation region of the finite element response*)." Lines 7-12, Page 4, OA

Applicant respectfully submits that the above statement (page 136) does not teach, disclose or suggest at least the step: "identifying high likelihood bifurcation region of a FEA model that represents the structural product by plotting an indicating quantity of the finite element analysis responses" recited in claim 1. This assertion teaches response surface methodology, which is a well known to one of ordinary skill in the art. Applicant does not claim response surface

methodology as the novel invention in the instant application. The novelty of the present invention pertains to methods and systems for distinguishing effects due to bifurcation from the effects due to design variable changes in a design experiment that uses response surface methodology.

As for the Examiner's statement regarding Figures 6.7 and 6.8 of Venkataraman, Applicant respectfully submits that the term "local bifurcation region of the finite element response" is not found anywhere in Venkataraman, and Figures 6.7 and 6.8 are different from "by plotting an indicating quantity of the finite element analysis responses" recited in claim 1.

The Examiner may be confused with the terms "response surface prediction load" and "local buckling load factor" used in these figures. In the example used in Venkataraman, a ring-stiffened cylindrical shell for the reusable launch vehicle liquid hydrogen tank (pages 163-164 and Figures 6.2 and 6.3) is used for demonstrating the methodology. The ring-stiffened cylindrical shell fails in two modes: general buckling and local buckling (last two lines in page 163). This means that Venkataraman teaches that known failure modes (i.e. general and local bucklings) are identified before the model is constructed and analyses performed, accordingly (e.g., Response surface using PANDA2 and/or STAGS). Whereas the invention in the instant application is different as shown in the combined steps of claim 1, the metamodel (e.g., a response surface) is constructed without the knowledge of any failure modes, then, and only then, the outliers are selected to be identified and examined for determining whether the effects are due to bifurcation or due to design variable changes.

Furthermore, Figures 6.7 and 6.8 of Venkataraman are very different from FIGS. 5 and 6 of the instant application, which represent the recited feature: "by plotting an indicating quantity of the finite element analysis responses".

Based on the above remarks, Applicant respectfully submits that the multiple steps recited in claim 1 are not disclosed, taught or suggested by Venkataraman and Tryon, viewed alone or in combination. Therefore, claim 1 shall be allowable over all of the cited references. Reconsideration of claim 1 is respectfully requested.

B. Independent Claims 7 and 13

Independent Claims 7 and 13 incorporate similar features recited in claim 1 and were rejected for the same or similar reasons as for claim 1. Applicant would like to apply the above remarks for claim 1 to support claims 7 and 13 also. Reconsideration of claims 7 and 13 is respectfully requested.

C. Dependent Claims

The dependent claims contain additional limitations further distinguish them from Venkataraman or Tyron, viewed alone or in combination. Therefore, claims 3-6 and 9-12 shall be allowable for at least the reasons stated above with regard to independent claims 1 and 7, respectively.

Summary

In summary, none of the cited references, viewed alone or in combination, have disclosed, taught or suggested the combined features recited in the pending claims. In view of the above remarks, Applicant believes that Claims 1, 3-7, and 9-13 shall be allowable over the cited references. Early and favorable action is being respectfully solicited.

If there are any questions regarding this amendment, the Examiner is respectfully requested to contact the undersigned at (408)255-6853.

No fee is required for this amendment, if it is determined that a fee is due in connection with this paper, the Commissioner is hereby authorized to charge payment of any fees associated with this communication or to credit any overpayment, to Deposit Account No. 553308, including any filing fees under 37 CFR 1.16 for presentation of extra claims and any patent application processing fees under 37 CFR 1.17.

I hereby certify that this correspondence is being transmitted to the Commissioner for Patents electronically on the date stated below.

Date: August 7, 2007

Signature: /Roger H. Chu, Reg.# 52745/
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Respectfully submitted;

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